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University of California

Ernest O. Lawrence Radiation Laboratory

LRL 25-INCH BUBBLE CHAMBER

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(Presented by Sulamith Goldhaber)

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I. INTRODUCTION

The recently completed 25-inch hydrogen bubble chamber combines excellent picture quality with a fast operating cycle. The chamber has a unique optical system and is designed to take several pictures each Bevatron pulse, in conjunction with the Bevatron rapid beam ejection system. At present the chamber operates twice per Bevatron pulse. The general features of the chamber construction are shown in Figs. 1 and 2. The chamber is ten inches deep at the narrowest point. The magnet is of conventional water cooled design and in present operation produces a vertical field of 18.5 kgauss. With suitable generators it has produced a field of 22.8 kgauss. The most important new features are discussed below:

A. Expansion System

Unique to this chamber is a movable top window which serves as the piston for the liquid expansion system and as an optical condenser lens. The system operates through a pressure multiplier driven by helium gas. The pressure

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≡ Deceased.

multiplier incorporates a gas spring which serves the following purposes:

1. To absorb the impact on expansion.
2. To provide adjustment for control of the expansion pressure.
3. To store much of the expansion energy (~80%). This feature is of importance for rapid cycling of the chamber.

B. Optical System

The optical system is shown in Fig. 3. The principal features are axial placement of the light source, the aspheric condenser and a generous stereo base (one half of the object distance). The aspheric condenser lens system is believed to be several times more efficient than any installed in earlier bubble chambers of this size. A scattering angle of 12° gives good uniformity of illumination in depth so that individual light sources for each stereo view are unnecessary.

The design of the camera was largely determined by the requirements of rapid pulsing. The camera utilizes a system of differential film drive capstans and an internally sensed programmed electric clutch. High speed vacuum platens were developed to clamp the film during exposure. The camera provides reference marks for theFlying Spot Digitizer and takes three stereo views on one 46 mm unperforated film.

C. Performance

The chamber has been operated filled with both hydrogen and deuterium. The Bevatron at present can produce two rapid beam ejections per pulse, and of the 700,000 pictures taken to date in hydrogen, 265,000 have been taken in this double pulse mode. Limitations on double pulsing are imposed at

present only by the requirement of compatibility when several experiments are simultaneously in operation at the Bevatron. At present the two pulses are separated by 275 msec. The picture quality is comparable on each of the two independently-controlled expansions.

FIGURE CAPTIONS

Fig. 1. The 25-inch bubble chamber and magnet.

Fig. 2. Detail of the 25-inch bubble chamber.

Fig. 3. Optical system of the 25-inch bubble chamber.

Fig. 4. First pulse 25-inch bubble chamber photograph.

Fig. 5. Second pulse 25-inch bubble chamber photograph.

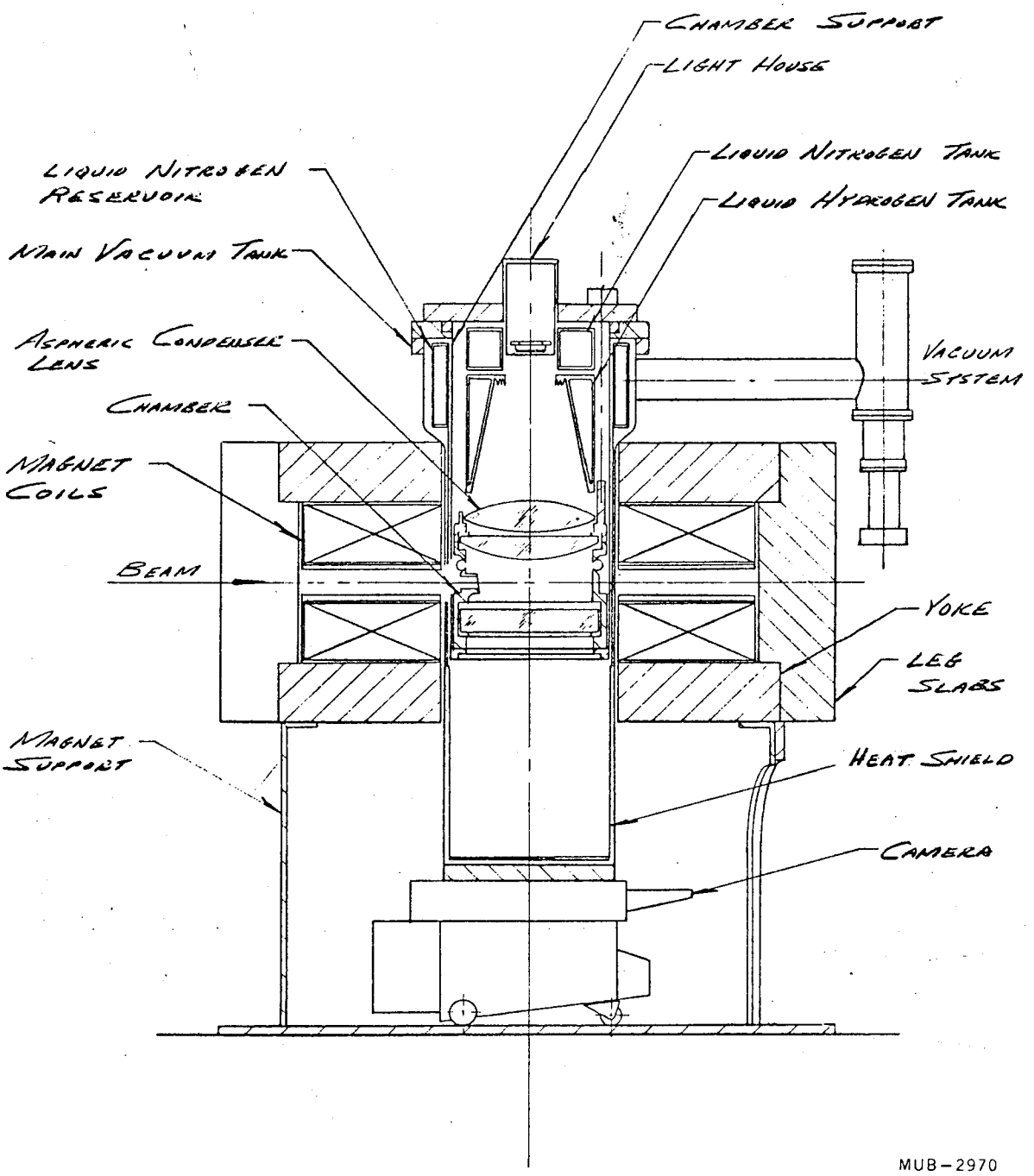
CHAMBER SUPPORT
LIGHT HOUSE
LIQUID NITROGEN RESERVOIR
LIQUID NITROGEN TANK
LIQUID HYDROGEN TANK
MAIN VACUUM TANK
ASPHERIC CONDENSER LENS
VACUUM SYSTEM
CHAMBER
MAGNET COILS
BEAM
YOKE
LEG SLABS
MAGNET SUPPORT
HEAT SHIELD
CAMERA
MUB-2970

Figure 1.

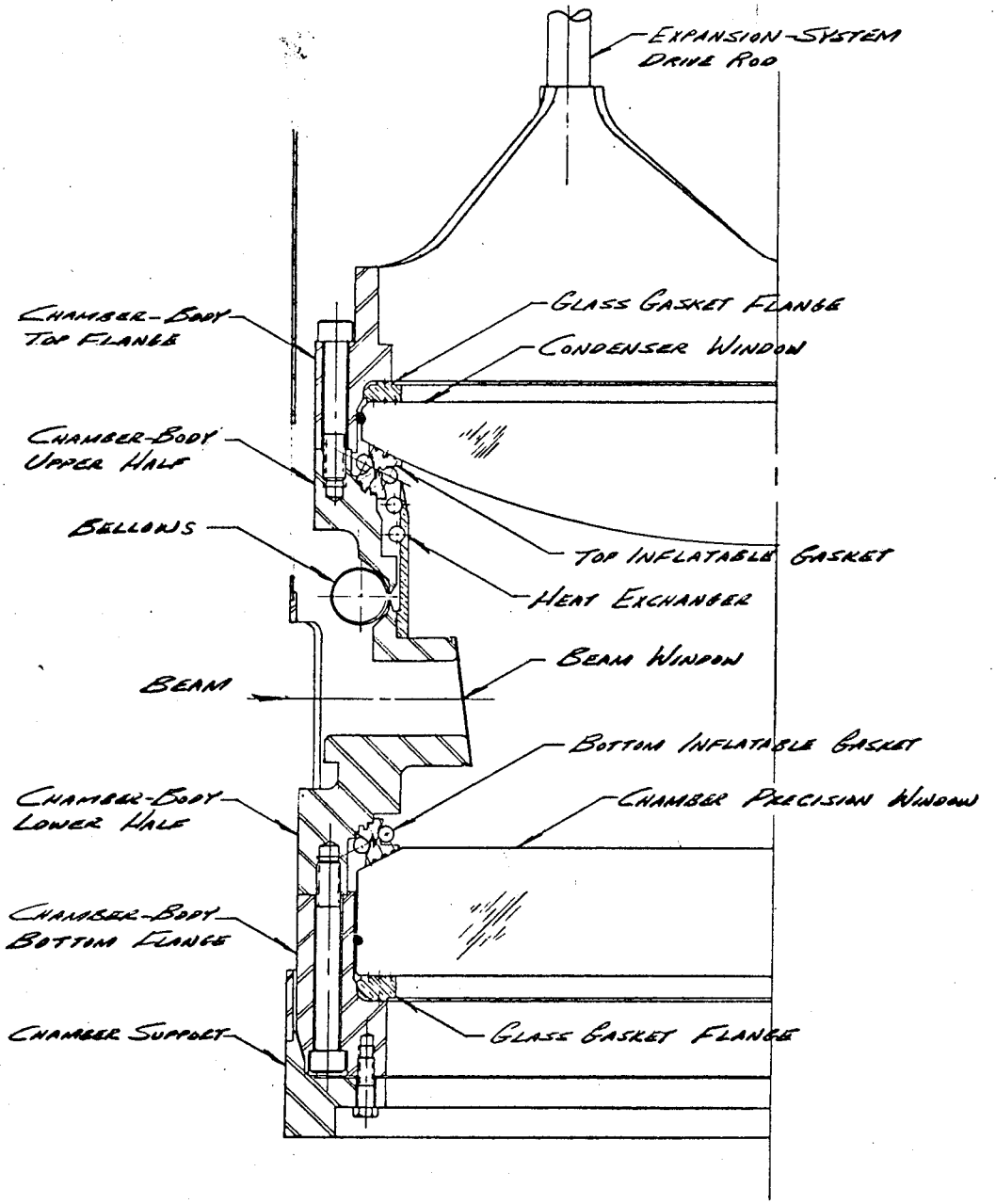
EXPANSION-SYSTEM DRIVE ROD
CHAMBER-BODY TOP FLANGE
GLASS GASKET FLANGE
CONDENSER WINDOW
CHAMBER-BODY UPPER HALF
BELLOWS
TOP INFLATABLE GASKET
HEAT EXCHANGER
BEAM WINDOW
BEAM
BOTTOM INFLATABLE GASKET
CHAMBER-BODY LOWER HALF
CHAMBER PRECISION WINDOW
CHAMBER-BODY BOTTOM FLANGE
CHAMBER SUPPORT
GLASS GASKET FLANGE
MUB-2971

Figure 2.

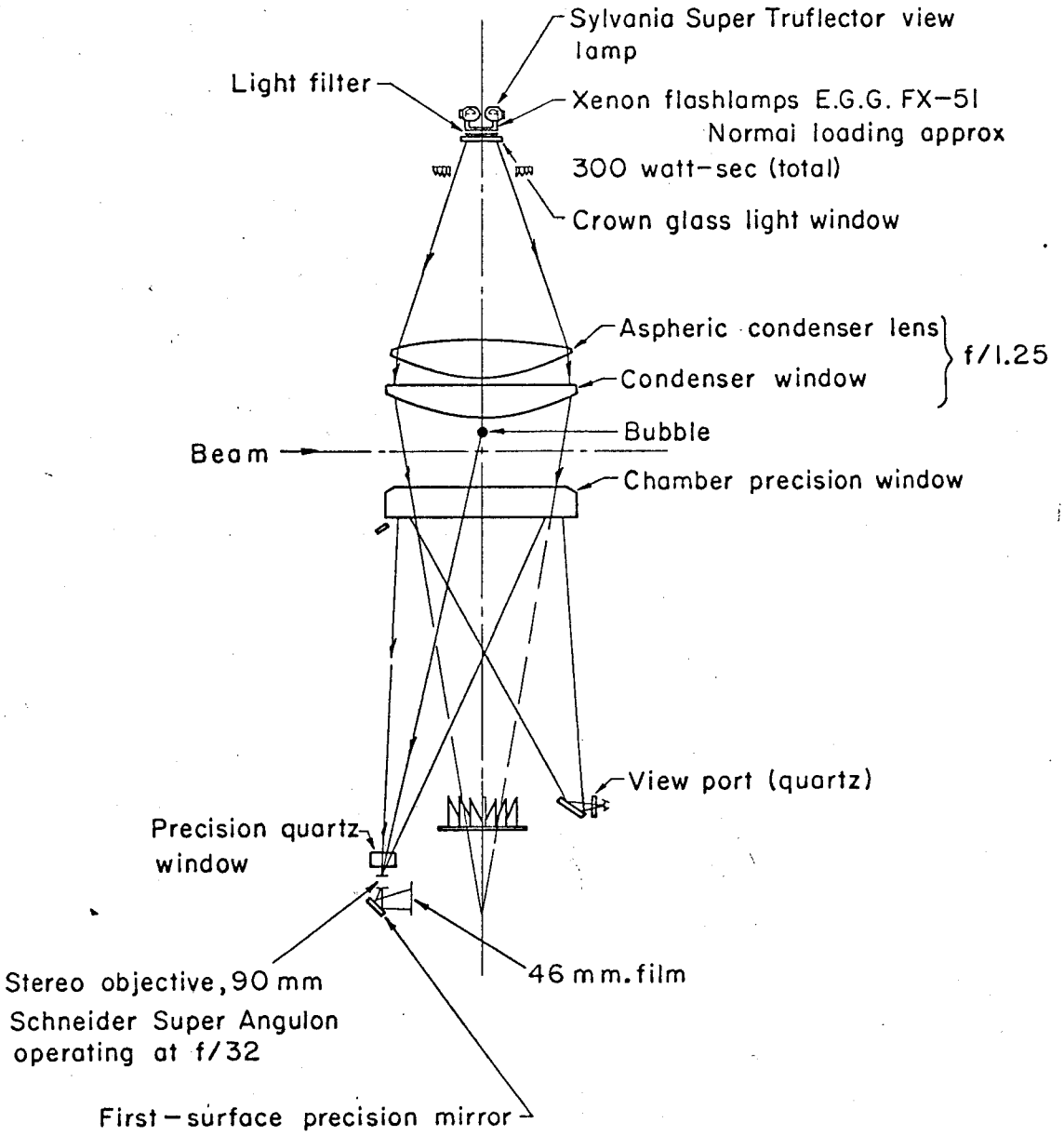
Sylvania Super Truflector view lamp
Light filter
Xenon flashlamps E.G.G. FX-51
Normal loading approx
300 watt-sec (total)
Crown glass light window
Aspheric condenser lens
f/1.25
Condenser window
Bubble
Beam
Chamber precision window
View port (quartz)
Precision quartz window
Stereo objective, 90 mm
Schneider Super Angulon
operating at f/32
46 mm. film
First-surface precision mirror
MUB-3380

Figure 3.

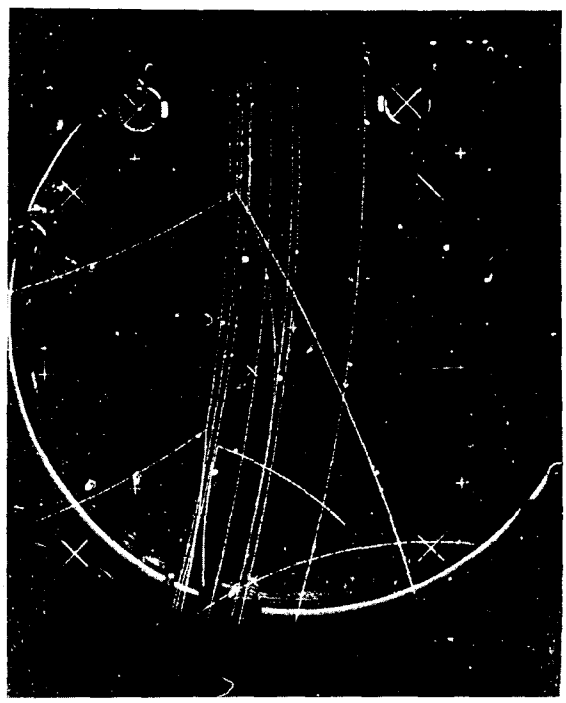

Figure 4.

ZN-4398

Figure 5.